USER MANUAL V1.0

Scavenger Transmitter Module
STM 420J / 429J

May 13, 2013

Observe precautions! Electrostatic sensitive devices!

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REVISION HISTORY

The following major modifications and improvements have been made to the first version of this document:

No	Major Changes
1.0	Initial version

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Important!

This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: http://www.enocean.com.
As far as patents or other rights of third parties are concerned, liability is only assumed for modules, not for the described applications, processes and circuits.
EnOcean does not assume responsibility for use of modules described and limits its liability to the replacement of modules determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities.
The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.
Components of the modules are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.
Packing: Please use the recycling operators known to you.

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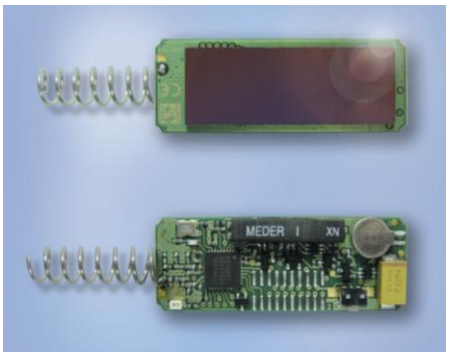
1 GENERAL DESCRIPTION

1.1 Basic functionality



The radio transmitter module STM 420J / 429J from EnOcean enables the implementation of a wireless magnet contact sensor. Powered by a solar cell, it works absolutely maintenance-free. An integrated energy store allows operation for several days even in total darkness. Key applications are window and door sensors.
The STM 420J / 429J supervises an integrated reed contact and reports every status change immediately (open <> closed). In addition a sign of life signal is transmitted every 20-30 minutes.
A LRN button is pre-installed on the PCB. When this button is pressed a special teach-in signal is sent.
STM 420J / 429J operates at 928.35MHz using FSK.

Features with built-in firmware

- Pre-installed solar cell
- On-board energy storage and charging circuit
- On-board LRN button
- On-board TX indicator LED
- On-board reed contact

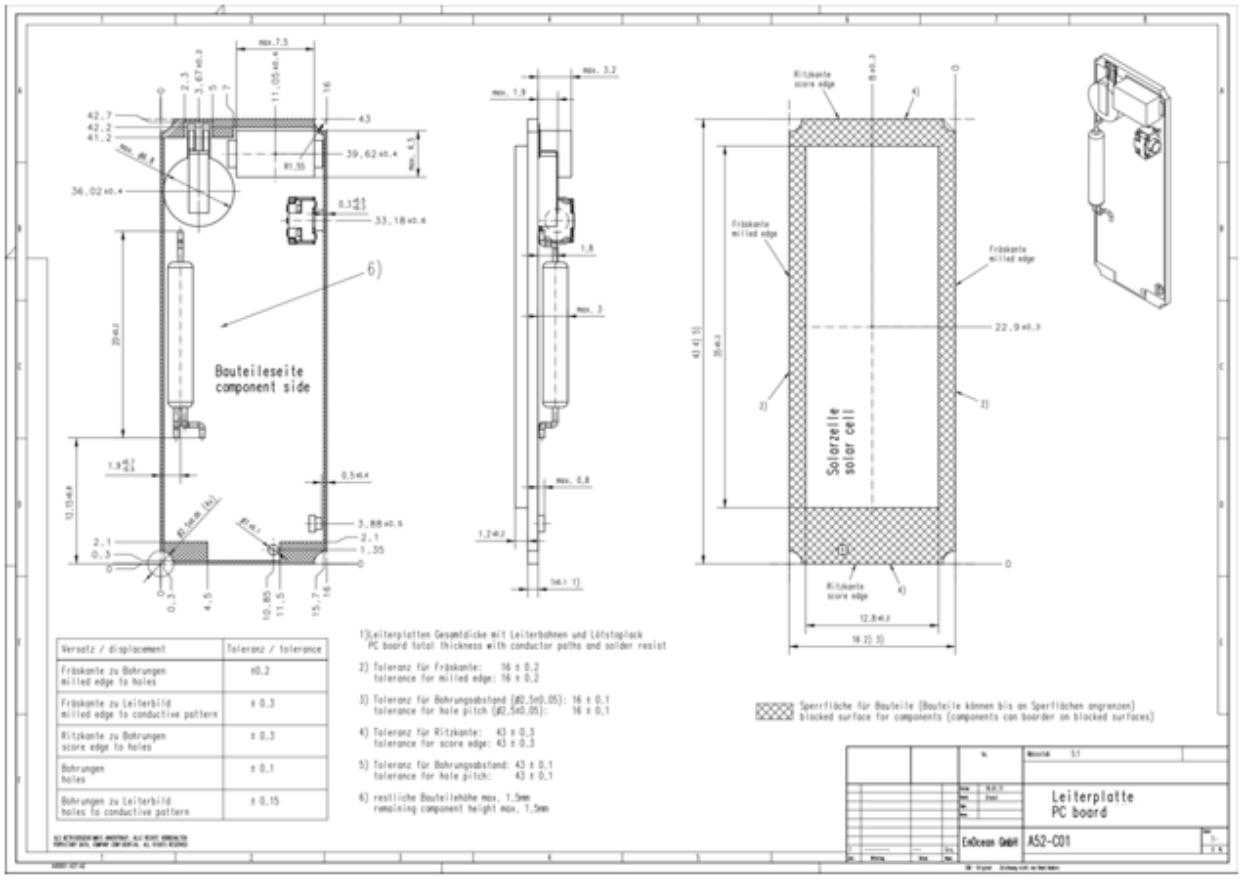
1.2 Technical data

Antenna	Pre-installed helical antenna installed
Frequency	928.35MHz
Data rate/Modulation type	125 kbps / FSK
Radiated Output Power	Typ. 0dBm
Power Supply	Pre-installed solar cell Illumination 50-100000 lux
Initial operation time in darkness @ 25°C	typ. 6 days, min 90 hours if energy storage fully charged transmission of telegram every 25 min on average[1]
Operation start up time with empty energy store	typ. 2.5 min @ 400 lux / 25°C incandescent or fluorescent light
Reed contact	1x internal, Meder MK23-90-BV14496 or MK01-I
Radio Regulations	ARIB STD-T108

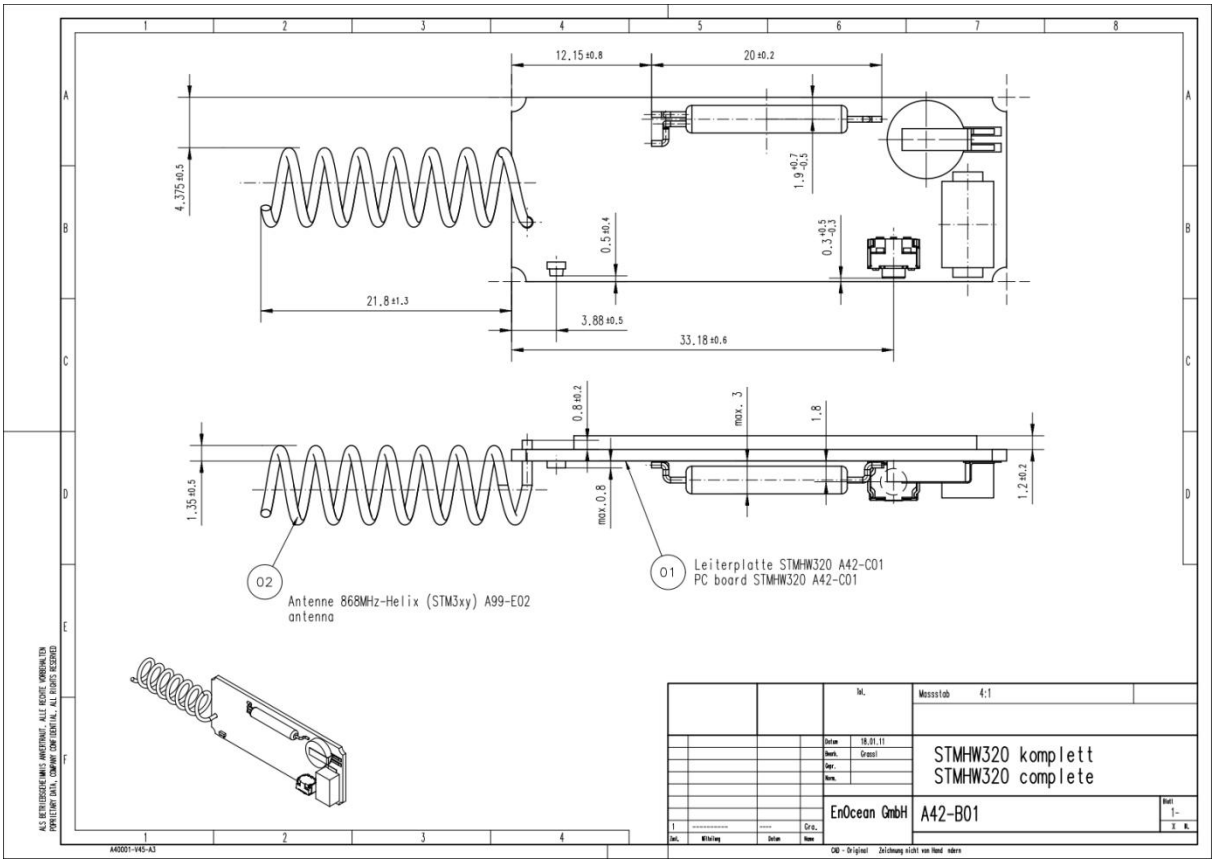
[1] Full performance of the PAS614L energy storage is achieved after several days of operation (up to two weeks) at good illumination level. Performance degrades over life time, especially if energy storage is exposed to higher temperatures. Each 10 K drop in temperature doubles the expected life span.

1.3 Physical dimensions

PCB dimensions	43±0.2 x 16±0.3 x 1±0.1 mm
Module height	6 mm
Weight	5.2 g



STM 420J PCB drawing (STM 429J implements vertical LRN button and LED)



STM 420J system drawing (STM 429J implements vertical LRN button and LED)

1.4 Environmental conditions

Operating temperature	-20 °C … +60 °C
Storage temperature	-20 °C … +60 °C, recommended[2]: +10 °C…+30 °C, <60%r.h.
Shelf life (in absolute darkness)	36 months after delivery[3]
Humidity	0% … 93% r.h., non-condensing

The module shall not be placed on conductive materials, to prevent discharge of the internal energy storages[3]. Even materials such as conductive foam (ESD protection) may have negative impact.

1.5 Ordering Information

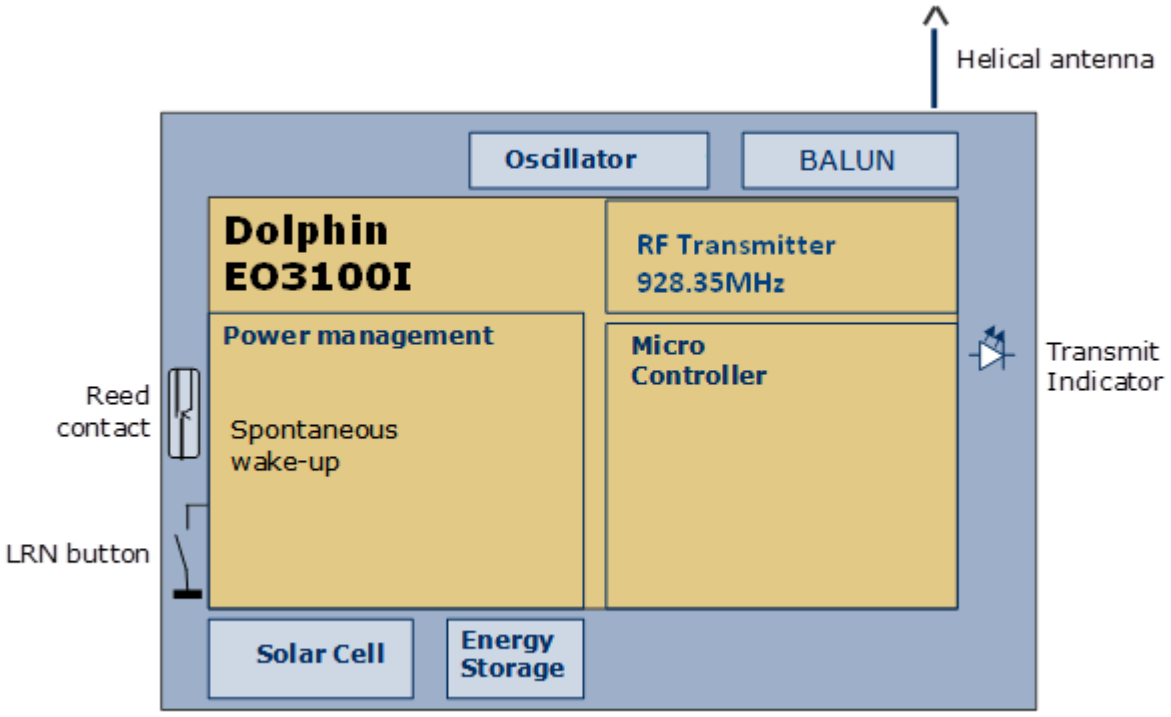
Type	Ordering Code
STM 420J	**S3061-D420**
STM 429J	**S3061-D429**

[2] Recommended for maximum life of energy storage capacitor

[3] Deep discharge of the PAS614L energy storage leads to degradation of performance. Therefore products have to be taken into operation after 36 months. At least the PAS614L needs to be recharged to 2.1 V.

2 FUNCTIONAL DESCRIPTION

2.1 Block diagram



A change of the reed contact status or pushing the LRN button will wake the transmitter unit to send a radio telegram immediately (reed contact position, LRN push button status, unique 32-bit sensor ID, checksum). In addition a redundant retransmission signal is sent to announce the contact status even in case of no input signal changes. This signal transmitted every 20-30 min, affected at random. The transmit indicator LED flashes briefly at every radio transmission.

Between the wake-up phases, the device is in sleep mode for minimum power consumption.

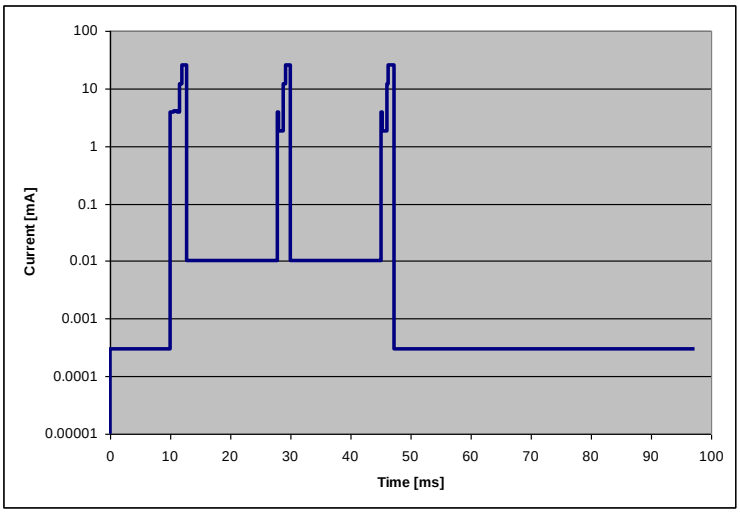
2.2 Radio telegram

STM 420J / 429J transmits a radio telegram according to EnOcean Equipment Profile EEP D5-00-01 as defined in the EnOcean Equipment Profiles 2.5 specification.

2.3 Transmit timing

The setup of the transmission timing allows avoiding possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment. With each transmission cycle, 3 identical subtelegrams are transmitted within 40 ms. The transmission of a subtelegram lasts approximately 0.9 ms. The delay between the three transmission bursts is affected at random.

2.4 Energy consumption



Charge needed for one measurement and transmit cycle: ~80 µC
Charge needed for one measurement cycle without transmit: ~10 µC

Calculations are performed on the basis of electric charges because of the internal linear voltage regulator of the module. Energy consumption varies with voltage of the energy storage while consumption of electric charge is constant.

From these values the following typical performance parameters at room temperature have been calculated:

Wake and transmit cycle [s]	Operation Time in darkness [h] when storage fully charged	Required reload time [h] at 200 lux within 24 h for continuous operation
1500	175	1.8

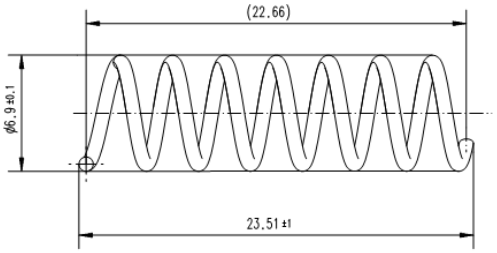
Assumptions:

- Internal storage PAS614L-VL3 (after several days of operation at good illumination level) with 0.25 F, Umax=3.2 V, Umin=2.3 V, T=25 °C
- Consumption: Transmit cycle 80 µC, measurement cycle 10 µC
- Pre-installed solar cell ECS 300, operating values 3 V and 5 µA @ 200 lux fluorescent light
- Current proportional to illumination level (not true at very low levels!)

These values are calculated, the accuracy is about +/-20%! The performance varies over temperature and may be strongly reduced at extreme temperatures.

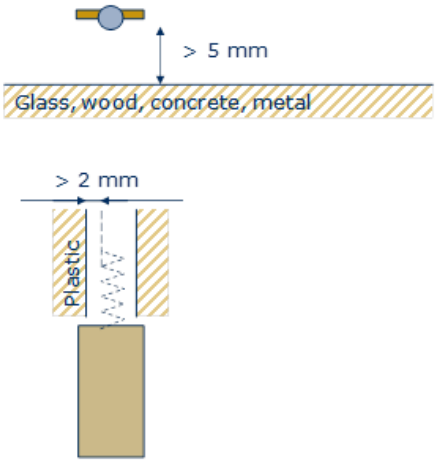
3 APPLICATIONS INFORMATION

3.1 Antenna Details

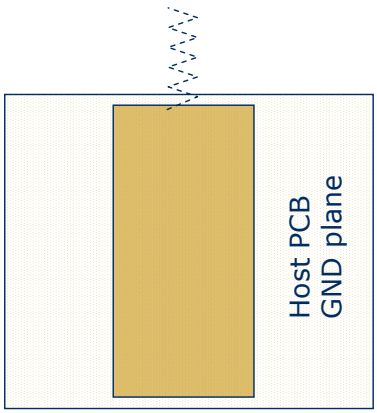


Antenna location recommendation

STM 420J / 429J without host PCB



STM 420J / 429J with host PCB



3.2 Transmission range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and "Dead" spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The following figures for expected transmission range are considered as a rough guide only:

- Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
- Plasterboard walls / dry wood: Typically 30 m range, through max. 5 walls
- Ferroconcrete walls / ceilings: Typically 10 m range, through max. 1 ceiling
- Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

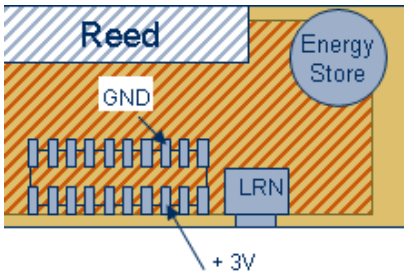
- Switch mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

The distance between EnOcean receivers and other transmitting devices such as computers, audio and video equipment that also emit high-frequency signals should be at least 0.5 m.

A summarized application note to determine the transmission range within buildings is available as download from www.enocean.com.

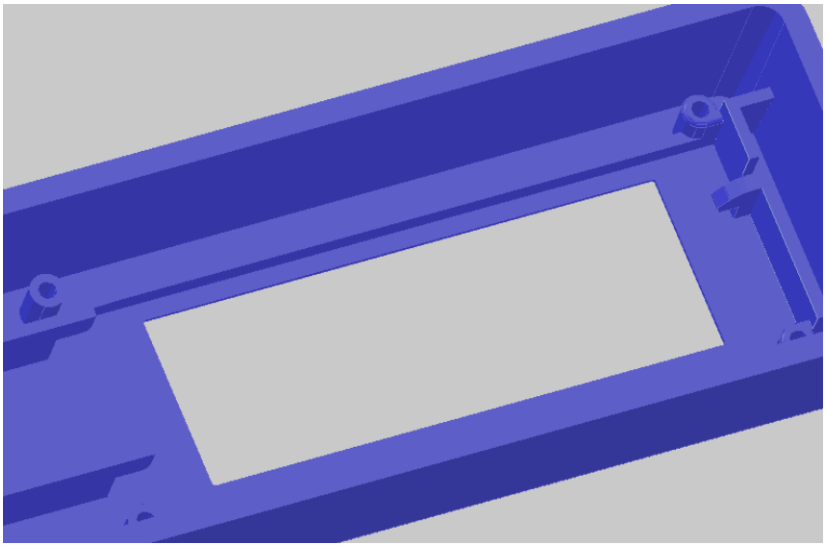
3.3 Connecting an external backup battery

In case there is not sufficient light available for operation with solar cell an external 3 V Lithium backup battery can be connected to the module at the soldering pads shown below:



3.4 Mounting STM 420J / 429J into a housing

The figure below shows an example of a housing in which the module can be mounted (with antenna pointing to the left). Design data of the housing and the modules is available in .igs format.



Please make sure not to exert shear force (side force within the plane of the solar cell) onto the solar cell! The maximum vertical force onto the solar cell must not exceed 4 N and should be homogeneously distributed! Bending of the PCB must be avoided!

Please make sure that the housing covers 0.5 mm at the solar cell edges. Within 0.5 mm off the edge flaking is possible due to the cutting process.

4 AGENCY CERTIFICATIONS

STM 420J / 429J will be tested to fulfil the approval requirements ARIB STD-T108 based on the built-in firmware.

5 Label Information